Please type a plus sign (+) inside this box [+]

PTO/SB/05 (12/97)
Approved for use through 09/30/00. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE



A

# UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

**Attorney Docket No.** 042390.P5113 Total Pages 2

**First Named Inventor or Application Identifier** David Horne

**Express Mail Label No.** EM441200237US

**ADDRESS TO:** **Assistant Commissioner for Patents**
**Box Patent Application**
**Washington, D. C. 20231**

**APPLICATION ELEMENTS**
See MPEP chapter 600 concerning utility patent application contents.

1. X Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. X Specification (Total Pages 11)
(preferred arrangement set forth below)
- Descriptive Title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claims
- Abstract of the Disclosure

3. X Drawings(s) (35 USC 113) (Total Sheets 4)

4. X Oath or Declaration (Total Pages 5)
   a. X Newly Executed (Original or Copy)
   b. ___ Copy from a Prior Application (37 CFR 1.63(d))
   (for Continuation/Divisional with Box 17 completed) **(Note Box 5 below)**
   i. ___ DELETIONS OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

5. _ Incorporation By Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. _ Microfiche Computer Program (Appendix)

7. __ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
a. ____ Computer Readable Copy
b. ____ Paper Copy (identical to computer copy)
c. ____ Statement verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

8. X Assignment Papers (cover sheet & documents(s))
9. __ a. 37 CFR 3.73(b) Statement (where there is an assignee)
__ b. Power of Attorney
10. __ English Translation Document (if applicable)
11. __ a. Information Disclosure Statement (IDS)/PTO-1449
__ b. Copies of IDS Citations
12. __ Preliminary Amendment
13. __ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
14. __ a. Small Entity Statement(s)
b. Statement filed in prior application, Status still proper and desired
15. __ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. __ Other: _____

17. **If a CONTINUING APPLICATION,** check appropriate box and supply the requisite information:
____ Continuation ____ Divisional ____ Continuation-in-part (CIP)
of prior application No: _

18. **Correspondence Address**

_____ Customer Number or Bar Code Label ____________ (Insert Customer No. or Attach Bar Code Label here)

or

X Correspondence Address Below

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Approved for use through 09/30/98. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE


# FEE TRANSMITTAL

**TOTAL AMOUNT OF PAYMENT ($)** 830.00

**Complete if Known:**
**Application No.** ______
**Filing Date** ______
**First Named Inventor** David Horne
Group Art Unit ______
Examiner Name ______
Attorney Docket No. 042390.P5113

**METHOD OF PAYMENT** (check one)

1. [ X ] **The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:**

   **Deposit Account Number** 02-2666
   **Deposit Account Name** ______

   [ ] **Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17**

   [ ] **Charge the Issue Fee Set in 37 CFR 1.18 at the Mailing of the Notice of Allowance, 37 CFR 1.131(b)**

2. X **Payment Enclosed**
   X **Check**
   _ **Money Order**
   _ **Other**

**FEE CALCULATION (fees effective 10/01/97)**

**1. FILING FEE**

| Large Entity Fee Code | Large Entity Fee ($) | Small Entity Fee Code | Small Entity Fee ($) | Fee Description | | Fee Paid |
|---|---|---|---|---|---|---|
| 101 | 790 | 201 | 395 | Utility application filing fee | $790.00 | |
| 106 | 330 | 206 | 165 | Design application filing fee | | |
| 107 | 540 | 207 | 270 | Plant filing fee | | |
| 108 | 790 | 208 | 395 | Reissue filing fee | | |
| 114 | 150 | 214 | 75 | Provisional application filing fee | | |

**SUBTOTAL (1)** $ 790.00

**2. CLAIMS**

| | | | Extra | | Fee from below | | Fee Paid |
|---|---|---|---|---|---|---|---|
| **Total Claims** | 10 | − 20 = | 0 | X | | = | |
| **Independent Claims** | 1 | − 3 = | _ | X | | = | 0 |
| **Multiple Dependent Claims** | | | _ | X | | = | |

| Large Entity Fee Code | Large Entity Fee ($) | Small Entity Fee Code | Small Entity Fee ($) | Fee Description | Fee Paid |
|---|---|---|---|---|---|
| 103 | 22 | 203 | 11 | Claims in excess of twenty | |
| 102 | 82 | 202 | 41 | Independent claims in excess of 3 | |
| 104 | 270 | 204 | 135 | Multiple dependent claim | |
| 109 | 82 | 209 | 41 | Reissue independent claims over original patent | |
| 110 | 22 | 210 | 11 | Reissue claims in excess of 20 and over original patent | |

**SUBTOTAL (2)** $ 0

## FEE CALCULATION (continued)

### 3. ADDITIONAL FEES

| Large Entity Fee Code | Large Entity Fee ($) | Small Entity Fee Code | Small Entity Fee ($) | Fee Description | Fee Paid |
|---|---|---|---|---|---|
| 105 | 130 | 205 | 65 | Surcharge - late filing fee or oath | |
| 127 | 50 | 227 | 25 | Surcharge - late provisional filing fee or cover sheet | |
| 139 | 130 | 139 | 130 | Non-English specification | |
| 147 | 2,520 | 147 | 2,520 | For filing a request for reexamination | |
| 112 | 920* | 112 | 920* | Requesting publication of SIR prior to Examiner action | |
| 113 | 1,840* | 113 | 1,840* | Requesting publication of SIR after Examiner action | |
| 115 | 110 | 215 | 55 | Extension for response within first month | |
| 116 | 400 | 216 | 200 | Extension for response within second month | |
| 117 | 950 | 217 | 475 | Extension for response within third month | |
| 118 | 1,510 | 218 | 755 | Extension for response within fourth month | |
| 128 | 2,060 | 228 | 1,030 | Extension for response within fifth month | |
| 119 | 310 | 219 | 155 | Notice of Appeal | |
| 120 | 310 | 220 | 155 | Filing a brief in support of an appeal | |
| 121 | 270 | 221 | 135 | Request for oral hearing | |
| 138 | 1,510 | 138 | 1,510 | Petition to institute a public use proceeding | |
| 140 | 110 | 240 | 55 | Petition to revive unavoidably abandoned application | |
| 141 | 1,320 | 241 | 660 | Petition to revive unintentionally abandoned application | |
| 142 | 1,320 | 242 | 660 | Utility issue fee (or reissue) | |
| 143 | 450 | 243 | 225 | Design issue fee | |
| 144 | 670 | 244 | 335 | Plant issue fee | |
| 122 | 130 | 122 | 130 | Petitions to the Commissioner | |
| 123 | 50 | 123 | 50 | Petitions related to provisional applications | |
| 126 | 240 | 126 | 240 | Submission of Information Disclosure Stmt | |
| 581 | 40 | 581 | 40 | Recording each patent assignment per property (times number of properties) | |
| 146 | 790 | 246 | 395 | For filing a submission after final rejection (see 37 CFR 1.129(a)) | |
| 149 | 790 | 249 | 395 | For each additional invention to be examined (see 37 CFR 1.129(a)) | |

Other fee (specify) Assignment ________ 40.00

Other fee (specify) ________ ________

SUBTOTAL (3) $ 40.00

*Reduced by Basic Filing Fee Paid

**SUBMITTED BY:**

Typed or Printed Name: David R. Halvorson

Signature [signature] Date 1/5/98

Reg. Number 33,395 Deposit Account User ID ________ (complete if applicable)

Docket No. 043290.P5113

United States Patent Application for

# A METHOD FOR USING ENCODED SPREADING CODES TO ACHIEVE HIGH BIT DENSITIES IN A DIRECT-SEQUENCE SPREAD SPECTRUM COMMUNICATION SYSTEM

09002948.010598


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"Express Mail" mailing label number: EM441200237US
Date of Deposit: January 5, 1998
I hereby certify that I am causing this paper or fee to be deposited with the United States Postal Service "Express Mail Post Office to Addressee" service on the date indicated above and that this paper or fee has been addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231

Lori Cox
(Typed or printed name of person mailing paper or fee)

Lori Cox
(Signature of person mailing paper or fee)

1/5/98
(Date signed)

## FIELD OF THE INVENTION

The present invention relates to the field of data communications. More particularly the invention describes a method of using encoded spreading codes to achieve high bit densities in direct sequence spread spectrum communication systems.

## BACKGROUND OF THE INVENTION

Direct Sequence Spread Spectrum (DSSS) techniques rely on the use of pseudo-noise carriers, also called spreading codes, spreading sequences, code sequences and chip sequences, and a transmission bandwidth which is much wider than the minimum required to transmit the information. The transmitter spreads the information by modulating the information with a pseudo-noise spreading sequence. At the receiver, the information is despread to recover the base information. This despreading is accomplished by correlating the received, spread-modulated, signal with the spreading sequence used for the transmission. DSSS is sometimes referred to by the shorthand name "direct spread."

The modulating signal, such as a pseudo-random spreading code signal, possesses a chip rate (analogous to carrier frequency) which is much larger than the data rate of the information signal. This characteristic is required for efficient spreading. Each state of the pseudo-random spreading sequence is referred to as a chip. The spreading sequence (chip sequence) directly modulates each bit of the information signal, hence the name direct spread. Pseudo-randomness of the spreading signal is required in order to recover the original information signal. Since the spreading sequence is deterministic, it can be exactly duplicated

at the receiver in order to extract the information signal. If it were truly random, extraction of the information signal via correlation receiver would not be possible.

The spreading operation causes the signal power to be depleted uniformly across the spread bandwidth. Thus, the spread spectrum signal will appear buried in noise to any receiver without the despreading signal. Consequently, it is not only difficult to jam, but is also difficult to detect its presence in any bandwidth. Any undesired signal picked up during transmission is spread by the receiver in the same way that the transmitter spread the desired signal originally. In other words, the receiver spreads undesired signals picked up during transmission, while simultaneously despreading, or demodulating, the desired information signal. Processing gain is the term used to express this interference suppression in the overall transmit/receive operation. When viewed as a transmit/receive operation, the desired signal is spread-modulated twice, giving back the original signal, while in-band interference is spread-modulated once, and thereby depleted across the full spread bandwidth.

## SUMMARY OF THE INVENTION

A method for achieving high bit densities in a direct-sequence spread spectrum communication system by using encoded spreading codes. First, an encoded pseudo-noise code is created. This encoded pseudo-noise code is then used to spread a first signal by modulating the first signal with the encoded pseudo-noise code.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

Figure 1(a) is a diagram showing a signal being spread.

Figure 1(b) is a diagram showing a spread signal with interference being demodulated into the original signal and noise.

Figure 2(a) is an exemplary prior art method of spreading signals.

Figure 2(b) is an exemplary method of spreading signals using an encoded pseudo-noise code.

Figure 3 is a block diagram of receiving and decoding the spread modulated signal of figure 2.

Figure 4 is a block diagram of a multiple user system implementing the encoded spreading method of Figures 2 and 3.

## DETAILED DESCRIPTION OF THE INVENTION

The disclosed method utilizes the oversampled nature of spreading codes in direct sequence spread spectrum techniques to encode the spreading codes. The encoding is accomplished by altering a single chip (a single state) within the spreading sequence. This conveys an additional 'n-1' bits per symbol (length of spreading sequence), where 'n' is the log-base-2 of the spreading code length. Information capacity is greatly increased over the conventional direct-sequence spread spectrum techniques, such as the one described above, with virtually no change in transmit power. In addition, the implementation is relatively simple and produces only a slight variation in the correlation properties of theoretically ideal correlation.

The excess bandwidth inherent in spread spectrum modulation can be exploited to increase information capacity, without sacrificing the benefits of the spread spectrum techniques. The over-sampled nature of the spreading code allows additional information to be embedded within. Because each spreading code symbol is represented by a large number of chips, a change to one chip of the length 'n' spreading code has minimal impact on the overall efficacy of the underlying spread spectrum technique, while significantly increasing the information capacity over conventional direct-sequence spread spectrum techniques.

Figure 1(a) shows an example of what occurs to a signal when it is spread. Signal 100 is spread using a spreading sequence (not shown) into signal 101. As can be seen, the amplitude of the signal is decreased, while its bandwidth is expanded. By reducing the amplitude, the signal will appear indistinguishable from noise, and can only be recovered by a receiver which processes the correct spreading sequence. Figure 1(b) shows the spread signal

101 and an interference signal 102 which has been picked up during transmission. When the spread modulated signal 101 is demodulated by using the original spreading sequence (not shown), the original signal 100 is recovered and the interference signal 102 is spread into signal 103, thereby being reduced to noise.

Figure 2(a) is a diagram of an exemplary prior art method of spreading a signal. An information signal 210 is modulated, using known methods, by a pseudo-noise code 211. For each '1' in the information signal, the pseudo-noise code 211 is transmitted. Whereas for each '0' in the information signal, the inverse of the pseudo-noise code 211 is transmitted. Thus, through such modulation, the signal is spread out for transmission into the transmitted signal 212. For example, if the information signal 210 consists of the bits '101' and the pseudo-noise code 211 is '01011010' then the transmitted signal 212 is '01011010 10100101 01011010.' This transmitted signal is created by '1' corresponding to the pseudo-noise code 211 ('010110101') and '0' corresponding to the inverse of the pseudo-noise code ('10100101').

Figure 2(b) is a diagram of an exemplary method of spreading a signal using an encoded pseudo-noise code. As described above, the information signal 210 is again modulated by a spreading signal to create a transmitted signal 214. However, in this case, instead of using a pseudo-noise code, an encoded pseudo-noise code is used. By using an encoded pseudo-noise code, multiple bits of information can be transmitted per each pseudo-noise code instead of a single bit, as described above. The encoded pseudo-noise code is created by inverting one bit in a pseudo-noise code wherein the inverted bit of the pseudo-noise code corresponds to the value of the information signal being sent. As a trivial example, if two bits of information are to be sent per each pseudo-noise code, a four bit pseudo-noise

code is required because two bits of information have a value ranging from zero to three. If the value of the information bits is 3 (the bits are '11'), then the third bit of the pseudo noise code is inverted, where the bits are numbered zero through three. The encoding operation provided by inversion of one bit of a pseudo-noise code results in high bit densities of transmitted data while still containing high correlation. In any set of non-trivial length spreading codes, inversion of one bit will have an insignificant effect on the correlation properties, therefore, even inverting one bit will still result in high correlation for these non-trivial code lengths. For example, in Figure 2(b), the same trivial information signal 210 ('101') and pseudo-noise code 211 ('01011010') of Figure 2(a) is used. In this case, since a binary '101' equals a numeric 5, the encoded pseudo-noise code is '01111010,' where the encoded pseudo-noise code is pseudo-noise code with the fifth bit inverted. Thus, the encoded pseudo-noise code corresponds to '101' and the transmitted signal is therefore the encoded pseudo-noise code of '01111010.'

Figure 3 shows the receipt and decoding of the transmitted signal. When the transmitted signal 214 from figure 2(b) is received, it is compared to the correlators for that pseudo-noise code 318. Each correlator is the pseudo-noise code 318 with one bit inverted where the location of the inverted bit indicates the value of the signal. The transmitted signal may be compared to the correlators simultaneously. When a match is found then the value corresponding to the correlator (which corresponds to the location in which and inverted bit was found) is read. This value is the value of the original signal. In this manner, the signal is demodulated, or despread. Using the example of the transmitted signal '01111010,' when it is compared with each correlator, it is found that it corresponds to correlator 315, where

correlator 315 is pseudo-noise code 318 with the fifth bit inverted. Therefore the decoded signal 320 is equal to the numeric value '5' and in a binary signal is '101.'

In the example described above, an eight bit pseudo-noise code was used to transmit three bits of information. Of course, other values could be used. For example, to transmit 2 bits of information at a time, a four bit pseudo-noise code is required. Similarly, to transmit 4 bits of information, a 16-bit pseudo-noise code is required, to transmit 5 bits of information, a 32-bit pseudo-noise code is required, to transmit 6 bits of information, a 64-bit pseudo-noise code is required, etc.

Figure 4 shows a block diagram implementing the above modulating and demodulating process in a multiple-user arena. The transmitting device 400 contains a table of orthogonal spreading codes 410, e.g. Walsh Codes. The use of orthogonal spreading codes allows each user to be assigned a different spreading code without any two users overlapping. For example, the first spreading code (code 1) 411, corresponds to user 1 450, the second spreading code (code 2) 412, corresponds to user 2 460, etc. down to code n 415 and user n 490. When a signal is to be sent, the pseudo noise code for the desired user 420 is chosen. The information signal 430 is then spread using encoded pseudo-noise codes 440 as described above. This signal is then transmitted. The transmitted signal is then received by the multiple users. Each user (450, 460) has correlators (451, 461) corresponding to the pseudo-noise code assigned to that user (411, 412) with one bit inverted corresponding the value of the signal, as described above. If the signal is intended for the user, then the correlators will find a match and the signal will be despread, or demodulated.

## CLAIMS

What is claimed is:

1. A method for achieving high bit densities in a direct-sequence spread spectrum communication system by using encoded spreading codes, the method comprising the steps of:

creating a first encoded pseudo-noise code;

spreading a first signal by modulating the first signal with the first encoded pseudo-noise code.

2. The method of claim 1, wherein the step of creating a first encoded pseudo-noise code comprises the step of:

modifying a first pseudo-noise code to create the first encoded pseudo-noise code.

3. The method of claim 2, wherein the first encoded pseudo-noise code is the first pseudo-noise code with one bit inverted.

4. The method of claim 3 wherein the position of the one inverted bit of the first encoded pseudo-noise code corresponds to the value of the first signal.

5. The method of claim 2, wherein a second encoded pseudo-noise code is the first pseudo-noise code with one bit inverted.

6. The method of Claim 3, further comprising the step of:

narrowing the first signal by demodulating the first signal with the first encoded pseudo-noise code.

7. The method of claim 6 where the step of narrowing the first signal by demodulating the first signal with the first encoded pseudo-noise code further comprises the step of:

demodulating the first signal into a value corresponding to the position of the inverted bit of the encoded pseudo-noise code.

8. The method of claim 1 wherein the first encoded pseudo-noise code corresponds to a first user.

9. The method of claim 1 further comprising the step of:

storing a table of encoded pseudo-noise codes wherein the pseudo-noise codes are orthogonal pseudo-noise code.

10. The method of claim 9 further wherein a second encoded pseudo-noise code located in the table corresponds to a second user.

ABSTRACT

A method for achieving high bit densities in a direct-sequence spread spectrum communication system by using encoded spreading codes. An encoded pseudo-noise code is first created. This encoded pseudo-noise code is then used to spread an information signal by modulating the information signal with the encoded pseudo-noise code. The same encoded pseudo-noise code is also used to demodulate the signal. The encoded pseudo-noise code is created by inverting one bit of a pseudo-noise code where the inverted bit corresponds to the value of the information signal.

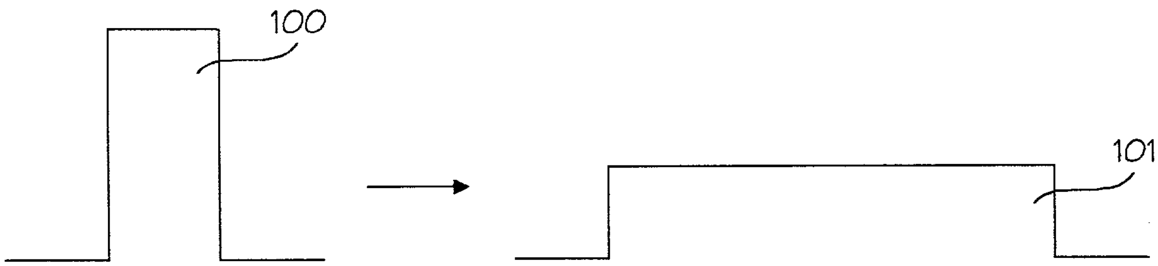


Fig. 1(a)

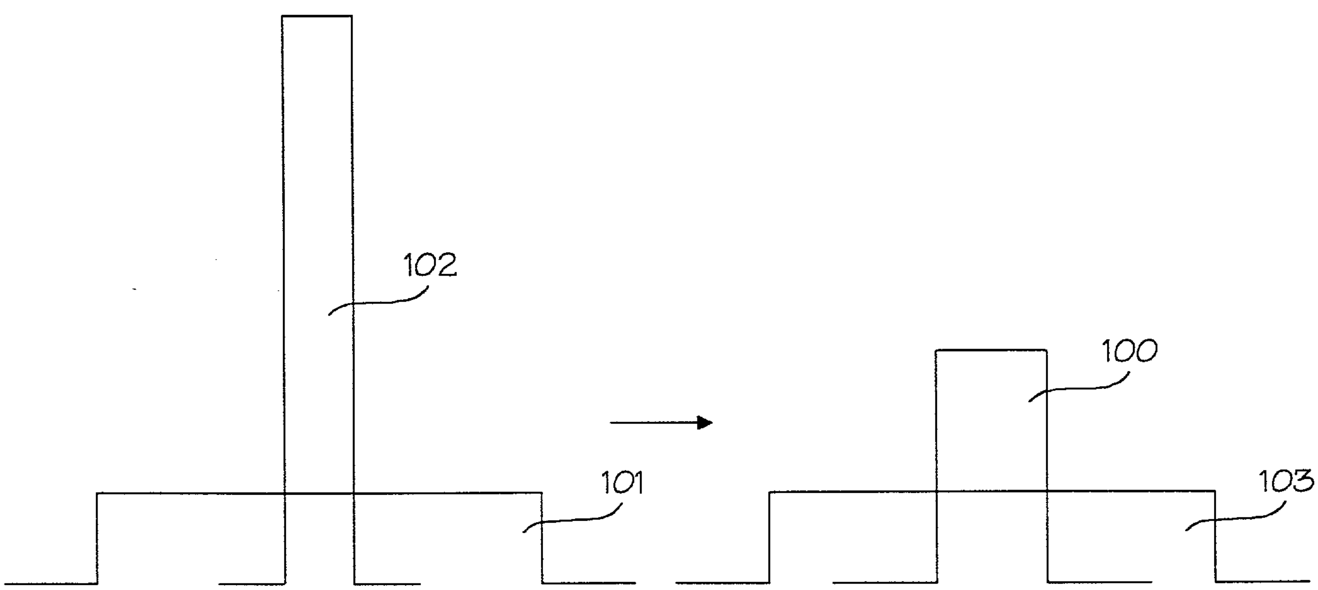


Fig. 1(b)

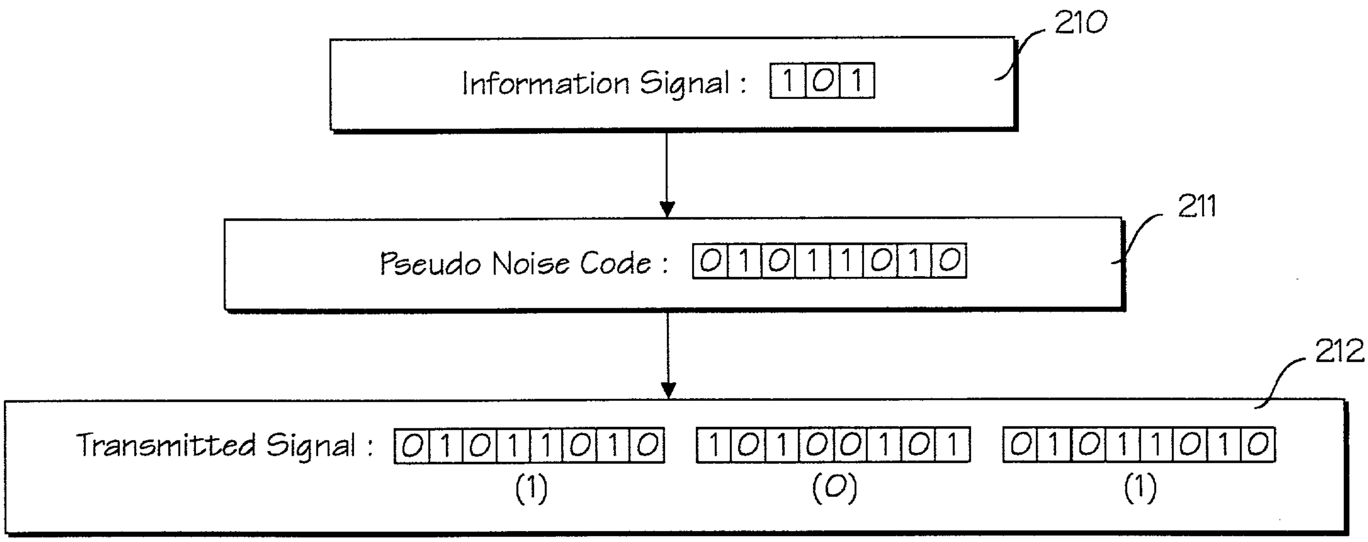


Fig. 2(a)
(Prior Art)

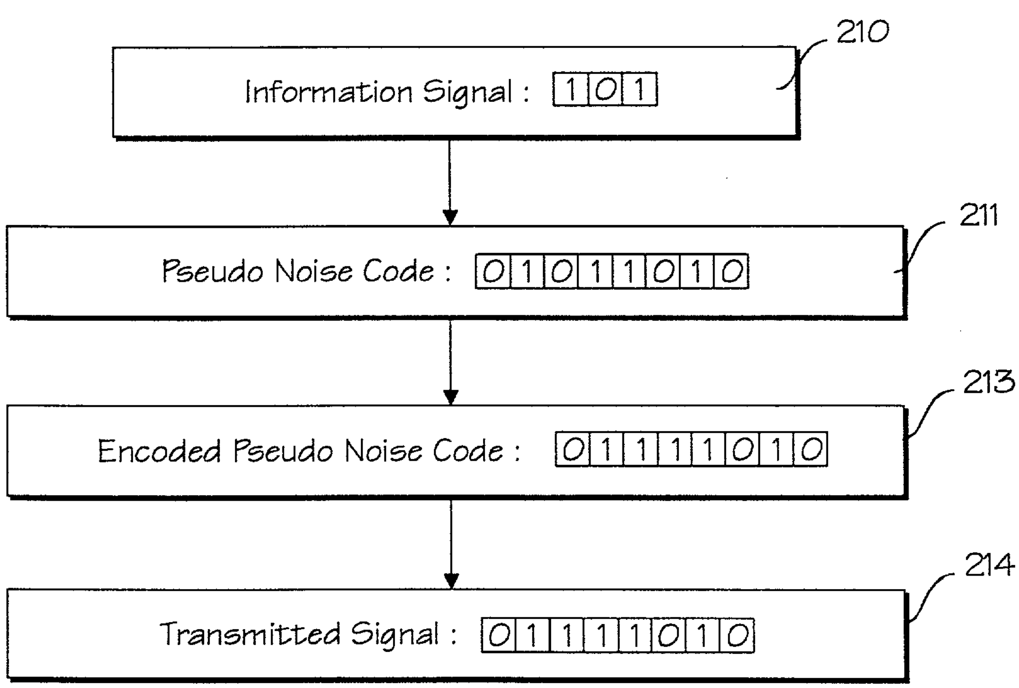


Fig. 2(b)

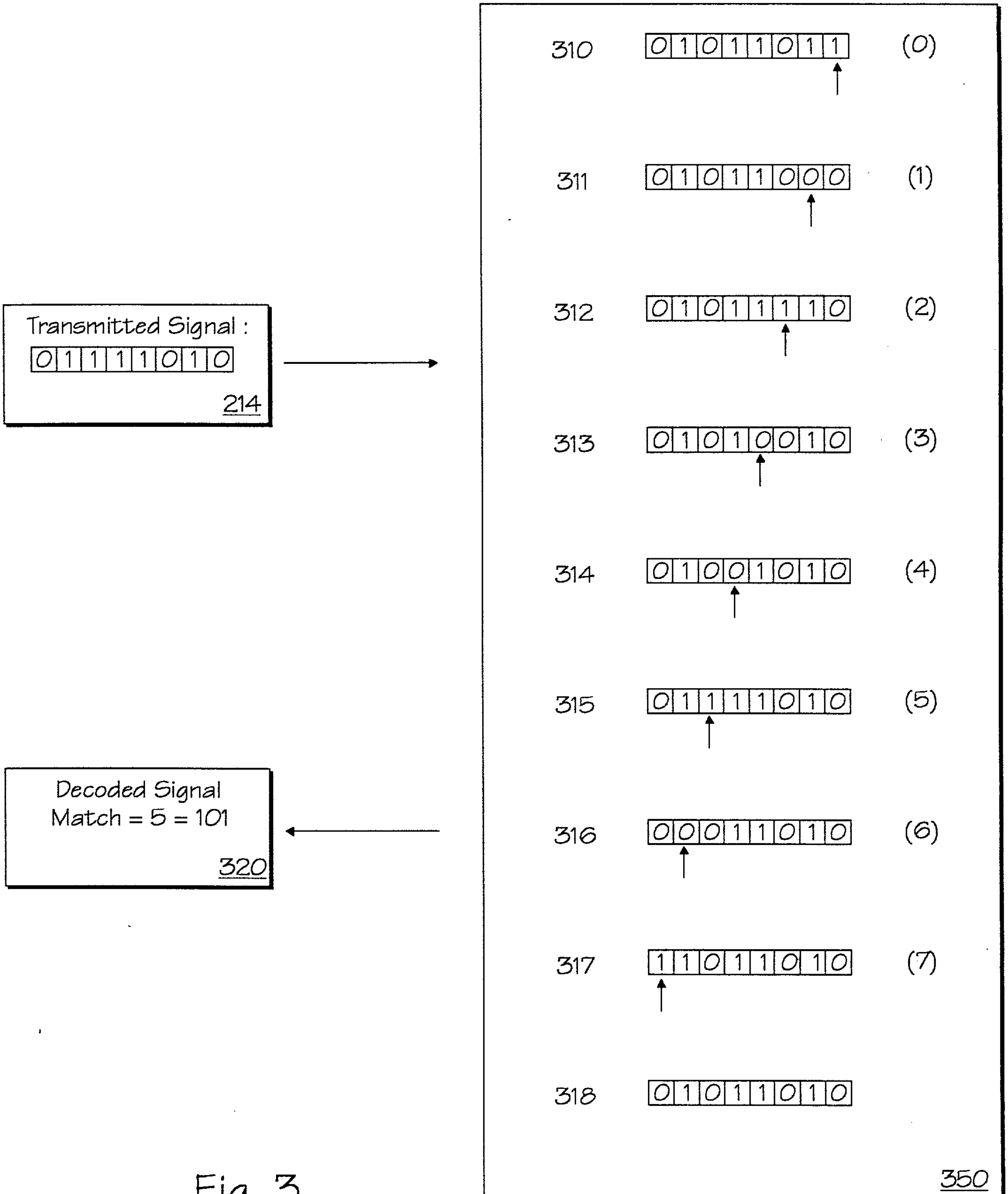
Transmitted Signal :
0 1 1 1 1 0 1 0
214
310 0 1 0 1 1 0 1 1 (0)
311 0 1 0 1 1 0 0 0 (1)
312 0 1 0 1 1 1 1 0 (2)
313 0 1 0 1 0 0 1 0 (3)
314 0 1 0 0 1 0 1 0 (4)
315 0 1 1 1 1 0 1 0 (5)
316 0 0 0 1 1 0 1 0 (6)
317 1 1 0 1 1 0 1 0 (7)
318 0 1 0 1 1 0 1 0
350
Decoded Signal
Match = 5 = 101
320

Fig. 3

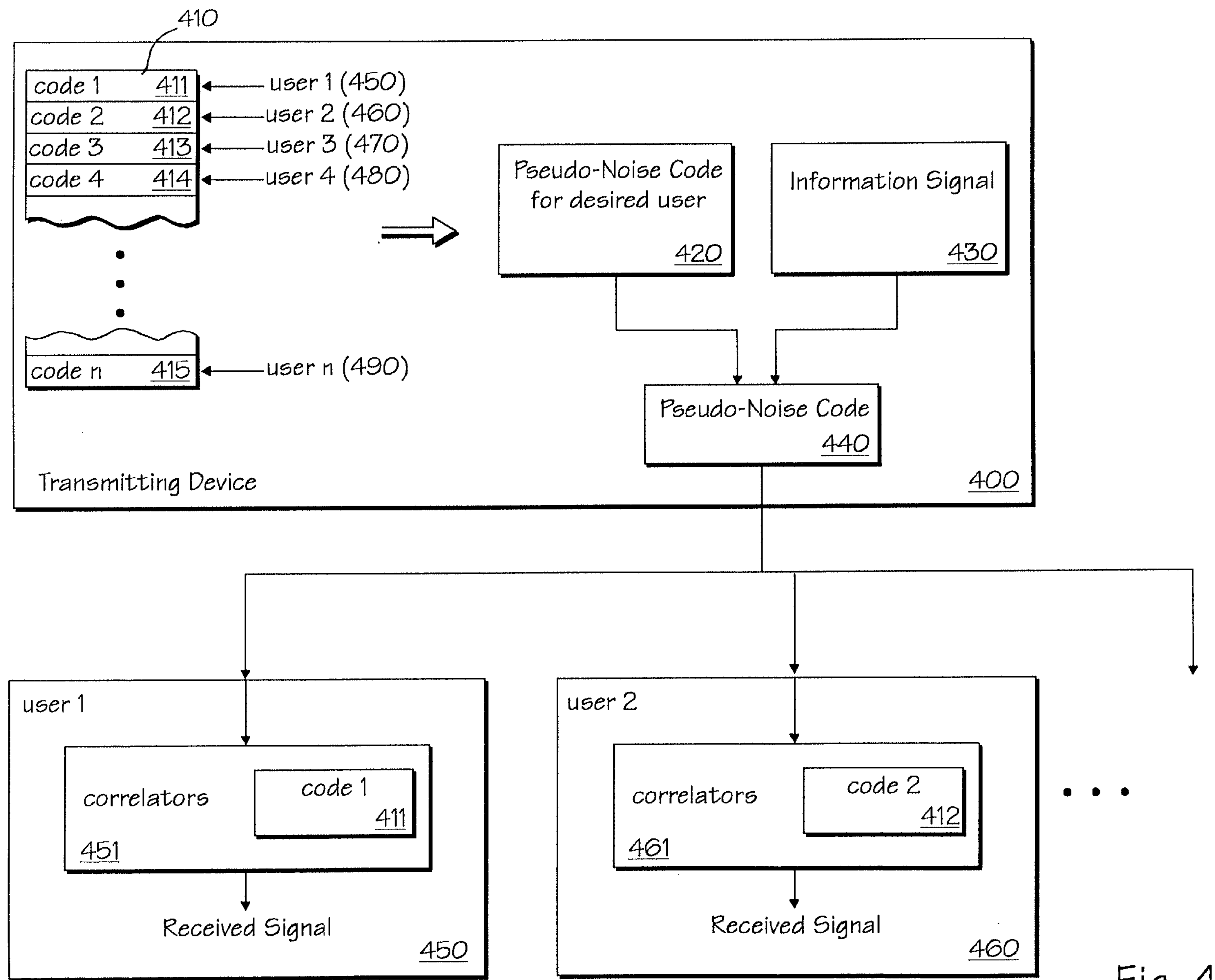
410
code 1
411
code 2
412
code 3
413
code 4
414
code n
415
user 1 (450)
user 2 (460)
user 3 (470)
user 4 (480)
user n (490)
Pseudo-Noise Code for desired user
420
Information Signal
430
Pseudo-Noise Code
440
Transmitting Device
400
user 1
correlators
451
code 1
411
Received Signal
450
user 2
correlators
461
code 2
412
Received Signal
460

Fig. 4

Attorney's Docket No.: 42390.P5113 PATENT

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION
(FOR **INTEL CORPORATION** PATENT APPLICATIONS)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**USING ENCODED SPREADING CODES TO ACHIEVE HIGH BIT DENSITIES IN A DIRECT-SEQUENCE SPREAD SPECTRUM COMMUNICATIONS SYSTEM**

the specification of which

X is attached hereto.
_____ was filed on ____________________ as United States Application Number ________________ or PCT International Application Number______________ and was amended on ____________________.
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

| Prior Foreign Application(s) | | | Priority Claimed | |
|---|---|---|---|---|
| (Number) | (Country) | (Day/Month/Year Filed) | Yes | No |
| (Number) | (Country) | (Day/Month/Year Filed) | Yes | No |
| (Number) | (Country) | (Day/Month/Year Filed) | Yes | No |

I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below

| | |
|---|---|
| (Application Number) | Filing Date |
| (Application Number) | Filing Date |

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

| | | |
|---|---|---|
| (Application Number) | Filing Date | (Status -- patented, pending, abandoned) |
| (Application Number) | Filing Date | (Status -- patented, pending, abandoned) |

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclosure information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclosure all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made or record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.